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ABSTRACT

Reading achievement tests have been used to identify deficiencies in inner city, poor readers: however, they often do not provide information about encoding strategies which lead some children to academic success. Immediate memory and visual analytic differences which contribute to the success of skilled readers are isolated in this study using 20 skilled and 20 poor readers in a sixth-grade urban school. The students' reading abilities were determined through word recognition and prose comprehension scores on the Silvaroli Classroom Reading Inventory. Skilled readers made fewer consonant memory errors in both high and low frequency positions. These sequence recall scores were also significantly different by sex, favoring females. Main effects between reading groups were not observed in their identification of similarities or discrimination of differences among pictures. However, skilled readers scored significantly higher in field independence than low readers. Implications for reading instruction are discussed. (Author/GSK)

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DIFFERENCES IN VISUAL ANALYSIS AND SEQUENCE MEMORY OF SKILLED AND POOR READERS[1,2]

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Differences in Visual Analysis and Sequence Memory of Skilled and Poor Readers

Abstract

The visual analytic and sequence memory performances of 20 skilled and 20 poor readers were examined. Reading abilities of sixth grade children were determined through word recognition and prose comprehension scores on the Silvaroli Classroom Reading Inventory. Both reading groups were given a consonant sequence memory task and 2 visual analytic tasks: a test of discrimination among pictorial concepts and a measure of field independence. Skilled readers made fewer consonant memory errors in both high and low position frequency conditions. These sequence recall scores were also significantly different by sex, favoring females. Main effects between reading groups were not observed in their identification of similarities or discrimination of differences among pictures. However, skilled readers scored significantly higher in field independence than low readers. Implications for reading instruction were discussed.

Differences in Visual Analysis and Sequence Memory of Skilled and Poor Readers

Several researchers concerned with performance differences between skilled and poor readers have focused on processes which affect recognition of single words. Decoding may be disrupted by such factors as inadequate visual memory (Velluntino, Steger, DeSetto & Phillips, 1975: Morrison, Giordani & Nagy, 1977), slowness in decoding (Perfetti & Hogaboam, 1975), inability to generate and test correctness of words in context (Samuals, Begy & Chen, 1977), and the complexity of rules for sound-letter correspondences (Guthrie & Seifert, 1977). Good readers may change their word recognition strategy from shape to initial letter position (Rayner, 1976). Word recognition is regarded by these researchers as an active, constructive process.

Another current research trend is to examine the influence of particular structural features of words and letters. One cognitive function that appears to distinguish between skilled and poor readers is memory not only for words but for sequences of letters. Torgesen (1979) noted that serial memory tasks can often help to identify children with potential learning problems. On the other hand, standardized achievement tests may not reveal certain processes which distinguish poor readers, such as a greater need for explicit instructions (Torgesen, 1977). There is also some evidence that skilled readers encode differently than poor readers. Although the length of sequence recalled did not pre-

dict differences in learning ability (Shuell & Giglio, 1973), a recognition task involving consonants in high frequency positions did differentiate between skilled and poor fifth grade readers (Katz, 1977). Mason, Katz and Wicklund (1975) found that skilled sixth grade readers recalled more consonants in sequences with letters in low position frequency for English words.

Another important contribution to performance differences between skilled and poor readers may be their style of visual analysis. Though some overlap between field independence and psychometric intelligence can be expected, this dimension of cognitive style influenced boys' responses to numerical tasks, but had little effect on their verbal achievement (Satterly, 1976). Field independence was also an important predictor of high performance on cognitive tasks independent of reading ability level (Gildemeister & Friedman, 1978). Although field independent children may be more proficient in visual analysis, the relative efficiency of their strategies for sequence recall needs to be established (Goodenough, 1976). Performance on visual tasks may not distinguish the skilled reader, but memory functions probably would (Morrison, et al., 1977).

The purpose of the present study was to isolate immediate memory and visual analytic differences which contribute to the success of skilled readers. Will skilled, inner city readers use different cues than poor readers in recall of consonant sequences? Will the superiority of skilled readers be associated with superiority in visual analytic tasks? These questions address the specifics of

cognitive operations which may contribute to a high level of academic achievement. They ask in what way immediate memory and visual strategies of children are related to reading success. These questions are important because reading achievement tests have been widely used to identify deficiencies in inner city, poor readers. However, most of these tests do not provide information about encoding strategies which lead some children to academic success. There has been little indication of how the skilled inner city reader has succeeded in spite of many obstacles to the attainment of competency.

Sixth graders skilled in reading were predicted to have more efficient memory for consonant sequences with high position frequency than poor readers. On the basis of Saltz and Sigel's (1967) findings with regard to attainment of pictorial concepts by younger children, and research on the contribution of visual skills to reading achievement, it was predicted that ability groups would not differ identifying similarities and discriminating differences among pictorial concepts. However, it was expected that they would differ on the more complex Children's Embedded Figures Test (Witkin, et al., 1971) which requires visual abstraction under conditions of uncertainty. Differences on the experimental tasks were predicted to be smaller than differences on a standardized achievement test, in accord with previous findings of contrasts between skilled and poor readers (Guyer & Friedman, 1975).

Method

Subjects

Forty children were selected from sixth grade classrooms in 2

public schools. The schools were located in the inner city of Washington, D. C. Most of the children were black and came from lower SES backgrounds.

Procedures

Teachers were asked to identify children in their classes that they considered either poor or skilled readers. Poor readers were defined as children in need of special remedial training in reading skills. Skilled readers were defined as children with reading abilities at or above their present grade level. The teacher selected children were then given the Classroom Reading Inventory (Silvaroli, 1978) to confirm the teachers' classifications and to provide objective information about differences between the reading ability groups. The Silvaroli is a reading diagnostic inventory which measures achievement levels in word recognition and comprehension of prose passages (Johnson, 1978). A word recognition score was obtained by using the grade level of the first word list read to a criterion of 90% correct (Form B, Pre-Primer through Grade 7). A comprehension score was obtained by calculating the mean of the pupil's grade level score when reading different prose passages.

Following determination of skilled and poor reading groups, subjects were individually administered 4 additional memory and visual analysis tasks. The presentation order of the following measures was counterbalanced for both ability groups:

1. Identification of Similarities. A version of the Saltz and Sigel (1967) pictorial concept task was used to obtain an identification of similarities measure. The task required children to match

3 photographs of boys differing in orientation and facial expression to a standard. An " overdiscrimination error" was made when a pupil asserted that the exemplar was a picture of a different child, when, in fact, the photograph was of the same child. A maximum of 24 errors in identifying similarities were possible from this task.

2. Discrimination of Differences. Again, the children were required to match 3 photographs of boys differing in orientation and facial expression to a standard. An "overgeneralization error" was made when a pupil asserted that the exemplar was a picture of the same child, when, in fact, the photograph was of a different child. Twenty-four errors in discriminating differences could be made.

3. Sequence Memory. The materials for this memory task consisted of black plastic letters mounted on 3" square cards. Five 4-letter sequences were constructed from 4 consonants in high frequency letter positions (e.g., FNBK). Five sequences were also constructed using the same consonants in positions of low frequency (e.g., NKBF). Appropriate sequences were determined through Mayzner and Tresselt's (1965) table of position frequencies for single letters in 4 letter words. Pupils within each reading group were assigned to either the high or low frequency position condition. Each item was exposed for a period of 2 seconds. Following presentation of each sequence each pupil's verbal recall was recorded by the tester. Error scores were tabulated by adding each pupil's omissions, sequence errors and intrusions over the 5 trials.

4. Field Independence. The Witkin, et al. (1971) Children's Embedded Figures Test was administered according to standard instructions to obtain a field independence score. This test assesses the ability of children to abstract figure from ground under conditions of uncertainty. The score reflects the number of correct trials on this task.

Results

Since preliminary analyses for school effects were not statistically significant, subjects from the 2 schools were combined. Reading scores on the Silvaroli were significantly different between the 2 teacher selected groups, $F(1,38) = 167.67$, $p < .01$. While females scored higher than males within both reading groups, the difference was not significant, F (1, 38) = 3.35, $p < .05$. Poor readers were found to be significantly older (M = 154.0 months) than skilled readers (M = 148.4 months), F (1, 38) = 4.40, $p < .05$. An explanation was that several of the poor readers had been kept at the same grade level one or more times. To control for this difference, age was used as a covariate in further analyses.

Means and standard deviations of performance measures are given in Table 1. As expected, skilled readers did better on all of the memory and visual analytic tasks. In addition, females had fewer memory and identification of similarities errors, as well as higher field independence scores. However, they did show more discrimination of differences errors, particularly when they were in the poor reader group.

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Insert Table 1 about here

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On the visual analytic measures none of the sex effects were significant. In subsequent one-way analysis of variance it was found that pupil errors on sequences with high position frequency (M = 3.80, SD= 3.90)did not differ significantly from their errors on low position frequency sequences. (M = 2.32, SD 3.00), F (1, 38) = 3.23, N.S. As shown in Table 2, memory of consonant sequences was significantly better for skilled readers, who made, on the average, less than 2 errors on the 5 trials. Females

scored significantly higher than males in recall of these consonant

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sequences, regardless of ability level. The reading groups did not differ in visual analysis of similarities and differences in pictorial concepts, but skilled readers were significantly more field independent than low readers.

Discussion

Sequence memory was observed to be an important component of skilled readers' performance. The sex difference in consonant memory may reflect a tendency for females to score better on verbal tasks throughout the elementary school years (Williams, 1977). Skilled readers were significantly more accurate than poor readers, performing to a criterion of 90% correct. Attentional problems of poor readers noted in previous research (Torgesen, 1977) might have contributed to their pattern of low word recognition scores combined with high sequence and omission errors. Anticipated differences between skilled and poor readers in utilization of position information in consonant sequences were not obtained. This might be the result of combining sequence and omission errors in obtaining the error scores. Alternative procedures, such as having pupils arrange consonants on tiles after they had previously been presented on a card or screen, might reduce the number of omission errors due to poor attention levels.

The visual analysis findings supported the assumption that differences between skilled and poor readers would more likely be revealed through a complex task than a task requiring simple feature discrimination.

One implication of this finding is that visual training in discrimination of fine differences in pictorial material may not benefit the verbal encoding of low readers. The association of high field independence with reading skill supports previous research which deminstrated the importance of this individual difference measure for academic achievement (Goodenough, 1976).

The low error rate in discrmination of visual concepts by all of these inner city sixth graders suggests that exercizes involving tasks of visual an verbal restructuring in task approach may be more challenging and encourage a greater diversity in cognitive style. According to Witkin et al. (1977), this objective of instruction is as important for children as recognition and utilization of diversity. The poor readers' strength in discriminating among socially relevant stimuli should be utilized to facilitate learning of verbal sequences.

On the other hand, instructional support in memory has previously been associated with reading improvement (Torgesen, 1979). However, the present findings suggest that this improvement may occur when pupils are only marginally reading disabled. When reading achievement is 4 years below grade level, as was the case for the average inner city poor reader participating in this study, a pupil may not resond to memory training with greater automatization of the decoding process. Differing effects of strategy training and memory organization for children at varying levels of achievement needs to be further studied.

Finally, a word about the effects of the age covariate. The fact that older, inner city poor children were more likely to be reading disabled than younger children would indicate that particular attention be

given to the strengths of poor readers, such as those employed in discrmination of socially relevant material. Otherwise, remedial instruction will only highlight the particular processing problems which impede decoding. Such problems have obviously existed longer for the older, poor reader.

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Table 1

Means and Standard Deviations of Memory and Visual Analysis Performance by Reading Ability Level and Sex

		Poor Readers		Skilled Readers	
Measure		Males	Females	Males	Females
Discrimination Errors	M	3.60	2.10	2.00	1.70
	SD	3.95	1.66	2.31	1.42
Overgeneralization Errors	M	2.10	4.10	1.90	1.80
	SD	2.61	4.72	1.66	1.40
Consonant Sequence Memory Errors	M	5.80	3.10	1.80	.80
	SD	4.08	2.88	2.57	1.14
Field Independence Score	M	8.70	11.30	14.10	12.31
	SD	4.11	4.16	4.91	3.56

Table 2

Analyses of Covariance of Memory and Visual Analytic Scores

Adjusted for Age Differences

Source	df	Discrimination Errors	Overgeneral-ization Errors	Sequence Mem-ory Errors	Field Independence
Reading Ability (R)	1	1.22	1.47	11.83**	4.91*
Sex (S)	1	1.16	1.06	4.31*	0.08
R x S	1	0.78	1.32	0.59	3.42

*$p < .05$

**$p < .01$